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Reorganisation

It is in keeping with the times that business, technical, and research organisations are devoting increasing attention to their structure, in order that, when peace comes, they can better serve the industries with which they are associated. The impact of war has strengthened some and weakened others, but nearly all feel the necessity for a thorough-going reorganisation. There is no common denominator, beyond a desire to give increased service to the members. Many seek increased membership, while a few are wondering by what means they can harness the great influx of new members to the machinery of existing activities and desirable extensions. To such associations many of the pre-war nebulous ambitions now become possibilities, providing the interest of the newcomers can be maintained and so stimulated that they will be the source of added recruitment. The normal method is by the assigning of duties to the maximum number of members. Herein lies the major difficulty, for there are the two obstacles of existing rules and the desire, based on experience, for small committees.

The logical answer is to follow the modern concept of production by breaking down the job into large numbers of small units by the creation of many committees with a limited, but well defined, field of activity. This ideal is only workable provided the organisation possesses the necessary permanent staff for recording and co-ordination. Moreover, it implies that firms must exercise an extremely enlightened policy as to the release of important members of their staff for the general good of the industry. As there have to be releases for employer, research and technical activities, it seems to us essential that the various directorates should establish a policy of co-operation, bearing in mind that some institutes only recognise individual membership. These are quite often of national importance and representation of their councils is not achieved by means other than a regular support and personality. Thus, directorates should be in possession of a list of their colleagues and staffs who are members of these bodies and provide facilities for attendance, just as they do for their workpeople who happen to be trade union officials.

Hence, for the carrying out of the programmes of these rapidly growing associations, the widest co-operation must be cultivated. The problem of a few associations is recruitment, and we sometimes wonder whether their plight is due to having placed too much reliance in pre-war days on a combination of social activities plus showmanship. The war has shown that these are not essential for material progress; they are only desirable for the dual, yet important, purposes of propaganda, and the opportunities they afford of widening one's industrial and technical circle of acquaintances which often ripen into friendships. The problem of these static associations, which war conditions may not have favoured, may be solved by a rational study of the minute books. It may be found that members have been led to expect developments, but nothing has matured; that subcommittees have been appointed but have never met; and that past planning has been on a scale beyond the financial resources available.

This ruminating over minute books will disclose that much good has been done and many things accomplished. These should be made the basis of immediate propaganda and the starting point for further progress, always bearing in mind that activities should bear some relationship to financial strength. The two should grow simultaneously, and will do where reasonable planning exists. The planning requires periodical revision to ensure that the programme envisaged carries popular support, possesses the requisite personnel for its launching and successful prosecution, and has available adequate finance.

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NOTES FROM THE BRANCHES

East Midlands.—The annual meeting was held at Derby on March 25. The following officers were elected for the 1944-45 session:—Branch-President, Mr. F. C. Butters; Vice-Presidents, Mr. F. Dunleavy and Mr. J. Roxburgh; honorary secretary, Mr. S. A. Horton; Councillors to serve for three years, Mr. H. J. Read, Mr. H. S. Joynes and Mr. C. A. Payne; for one year, Mr. R. F. Orme. Representatives on the General Council, Mr. F. Dunleavy, Mr. A. E. Peace and Mr. G. L. Harbach; on the Technical Committee, Mr. A. E. Peace. Branch auditors, Mr. A. B. Bell and Mr. R. H. Buckland.

After the balance sheet had been approved, the secretary submitted his report, which primarily recorded the continued success of the Branch. Seven meetings had been held and, although the attendance at one meeting was very disappointing, the average attendance throughout the session was a record for the Branch. The subjects presented had been very well received, and thanks were due to the lecturers who had so kindly visited the Branch. The session opened with a visit to the Butterley Company, Limited, and an attendance record for a Branch meeting was created. A fortnight later the Lincoln Section very kindly invited the Branch to join with them in a visit to Harrison & Company (Lincoln), both visits being very enjoyable. The Branch Council appreciated the helpful manner in which firms in the East Midland area co-operated and not only permitted visits to their works, but also entertained them generously. The Branch membership now exceeded 250 and the balance sheet showed that the finances were quite sound.

The Lincoln Section was very active and the continued growth reflected credit on the work of the section officers and Council. Due to war conditions, the Branch Council and members were unable to give them the assistance and support they felt they had a right to expect, but perhaps before the next session opens, happier days might be with them.

The annual social event was held on March 17, 1944, at "The Irongates," Derby, and, despite the limitations in food, good spirits abounded. The Branch was again honoured by the company of several distinguished guests. In concluding, the secretary expressed his thanks to the Branch officers and Council for their guidance and assistance throughout the session.

The meeting closed with a hearty vote of thanks to the President for his work during the session, all members present supporting. The annual short Paper competition was then held.

The [American] Office of Price Administration has appointed a Grey Iron Casting Industry Advisory Committee composed of eleven officials representing the actual foundries.

The American Foundrymen's Association announce the formation of yet another chapter. It is to be known as the East Central Ohio Chapter, and will be based in the city of Canton.

AMERICAN FOUNDRY EQUIPMENT INDUSTRY

EXPANSION OF OUTPUT

The Tools Division of the American War Production Board has announced that expansion of foundry equipment and electric metal melting furnace manufacture, accomplished in recent months, has made possible increased production of castings for lorries, engine parts for landing craft, and other war goods to meet additional military programmes.

Production of foundry moulding machines, on which there is a backlog of unfilled orders equivalent to five to eight months' production, also is being increased. Additional sub-contracting is contributing to this increase. Supplies of chilled-iron grit for finishing surfaces of war material have been stepped up recently.

The Board has released foundry statistics for 1943, broken down by months, which show that shipments of electric metal melting furnaces for last year were valued at 10,345,000 dollars and orders at 9,975,000 dollars. Shipments valued at 1,370,000 dollars in May and 1,470,000 dollars in September were peaks for the year.

Statistics on foundry equipment show that the trend of orders rose from about 2,000,000 dollars in September to about 3,500,000 dollars in October, November and December, largely as a result of the accelerated lorry programme.

Reduction of Unfilled Orders

Despatches of foundry equipment in 1943 were approximately 70 per cent. higher than orders. Shipments totalled 24,038 tons and orders 141,345 tons last year. The overall backlog of unfilled orders was reduced from nearly four months' production at the end of January, 1943, to about two months' production at the end of the year.

Releases of monthly shipments and orders figures on foundry equipment and electric metal melting furnaces are in line with the new War Production Board policy of wider dissemination of data which industry can use in business analysis and business planning, now that the production effort has progressed to a point where such data can no longer give any aid to the enemy.

Foundry equipment includes annealing ovens (malleable castings); blast-cleaning equipment; sand or metal abrasive; briquetting equipment for iron and steel borings and turnings; coremaking and core crushing machines; cupolas; dust collecting equipment; ladles, for transporting and pouring iron, steel and non-ferrous metals; moulding machines; conveyors, moulds and moulding sand; ovens, core and mould sand reclaiming equipment; sand-handling and sand-preparation equipment; shakeout equipment; chilled-iron shot and grit for blasting; Tumblast and Rotablast equipment; tumbling barrels and mills for cleaning castings. These data are based on the reports of approximately 90 companies, and represent approximately 95 per cent. of the industry.

CAUSES OF POROSITY IN GUNMETAL CASTINGS

Saving castings and improving production through reducing the number of rejects

By W. B. GEORGE

The porosity encountered in gunmetal and similar alloys is so closely related that they can be discussed together. The lead in some of these alloys promotes pressure tightness and machinability.

For simplicity, let us select a cylinder liner 16 in. inside diameter, 18 in. outside diameter, and 24 in. long. This liner is to be finished and to withstand 250 lbs. per sq. in. air pressure. The finished castings must be free of all imperfections, and subject to test-pieces cut from any section to check density and physical properties. Metal to be composition "G" of the specifications shown in Table I.

In the making of castings of this type, most of the known causes of porosity will be brought out before such castings can be made consistently good. The porosity encountered in these liners is the same as in other types of castings, where such defects are often hidden by an unmachined surface.

TABLE I—*Chemical and Physical Specifications of Navy "G" (Gunmetal) Alloys*

Composition	
86.00 – 89.00	Copper, %
7.50 – 11.00	Tin, %
0 – 0.30	Lead, %
1.50 – 4.50	Zinc, %
0.10	Iron, Max., %
1.00	Nickel, Max., %
0.05	Phosphorus, Max., %
Minimum Physical Properties	
18.0	Tensile Strength, tons.
20	Elongation in 2–in., %

The following are some of the causes of porosity in this type of work due to imperfect foundry practice.

Effect of Low Permeability

Fig. 1 shows a type of porosity due to too low permeability of the moulding sand. The holes vary in colour, some being black, green, brown, red, orange and yellow. This defect often affects pressure tightness. These are water vapour holes from metal boiling in low permeable sand. Slag deposits will be found among the holes, associated with green skin films embedded in the castings.

The sand permeability is probably around 12, where 40 would be more satisfactory. Test-bars under this condition probably will be lost, showing only about 15.5 tons per sq. in. tensile strength and 18 per cent. elongation.

There are two kinds of water vapour, one that shows up as holes and is seen by the naked eye, another which separates at the grain boundaries and may be seen with a 10 power magnifying glass. Both classes affect this casting.

Low Sand Strength

Fig. 2 shows a type of porosity caused by too low strength in the moulding sand. The colour of the holes varies from golden red to golden yellow. This defect does not affect the pressure-tightness of the casting.

This type porosity is caused by water vapour holes from loose sand grains washed into the castings from the sprue and gate. The combined water of the sand grains and clay has been driven off by the high temperature and has sintered the residue into a tiny cinder within the hole. The water has expanded hundreds of times its original dimensions. The sintered residue is usually about 0.005 in. dia., and may be seen with a 10 power glass. The green strength of the moulding sand is probably about 5 lbs. per sq. in., whereas 8 lbs. per sq. in. would be much better.

Some of the test-bars cast under this condition will be lost, while others will barely pass, showing a tensile strength of about 18 tons per sq. in. and an elongation of 20 per cent. Here again, some of the water vapour has entered the grain boundaries of the metal.

Moulding Sand Too Wet

Fig. 3 shows a type of defect due to the moulding sand being too wet. The grains of metal in the defective area have a crystal sugar appearance. The colour of the fracture is from grey to golden yellow. This may or may not affect pressure tightness, depending on the degree the metal has been damaged.

The crystalline appearance is due to water vapour from steam, showing up as a granulated structure. This also can be seen under a 10 power glass. Other causes of this defect are strong facings or wet blacking. In such cases, the mould should be skin dried when faced or blackened.

Test-bars cast under this condition will be lost, showing about 15.5 tons per sq. in. tensile strength and 18 per cent. elongation.

Gas from Core Buckling

Fig. 4 shows a gas-hole defect caused by gas generated by a core buckle. The holes occur in a straight line and are orange to golden yellow in

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* This Paper was presented to a meeting of the American Foundrymen's Association. The author is Foundry Engineer to R. Lavin & Sons, Inc.

Causes of Porosity in Gunmetal Castings

colour. This defect usually is associated with embedded core sand. The defect does not affect the pressure-tightness of the casting.

Overbaked and underbaked core halves should not be pasted together, because the expansion is greater in the overbaked than the underbaked side and the core will buckle, throwing core sand and gas into the casting. Sometimes the halves will rip loose on the pasted seam with the same disastrous results. Halves on large cores should be of the same mixture and baked in the oven at the same time.

Gas from Oxidised Metal

Fig. 5 illustrates the occurrence of gas holes around a core, said to be caused by oxidised metal. The holes range in colour from dark red to golden yellow in some castings. In other castings the holes may be black, green, orange and yellow. This defect does not affect pressure-tightness of the castings.

Where such a defect occurs, it is assumed that the oxygen in the metal reduces the core binder to CO, CO_2, etc. Often there are other reactions between the metal and core. All conditions have to be known to place this trouble where it belongs. Oxidised metal should be reduced with phosphorus before pouring over cores.

Swab Used Too Freely

Fig. 6 illustrates the result of using the swab too freely. The holes appear clean and in a straight line. They range in colour from golden red to yellow. This defect does not affect the pressure-tightness of the casting.

Similar small gas holes often result from a slag, formed by metal boiling in the sprue or runner. Release of the combined water in the clay-sand mixture is not completed until the slag enters the casting. These holes can be traced by a fracture to the inclusion.

Neutral slag does not throw off gas. The runner of the casting usually shows the fused white colour of sand on the skin. Metal will dissolve the linings of improperly glazed ladles and show similar results, but, as a rule, with more slag and less gas holes. Test-bars under these conditions will fail, pulling probably only 15.5 tons per sq. in. tensile strength with 18 per cent. elongation.

Ladles Not Dry

Fig. 7 shows a defect attributable to undried ladles. This defect is characterised by fine orange to yellow

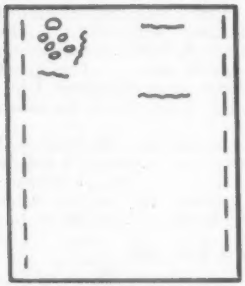

FIG. 1.

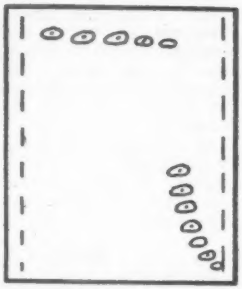

FIG. 2.

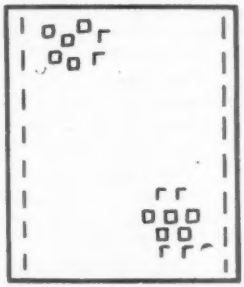

FIG. 3.

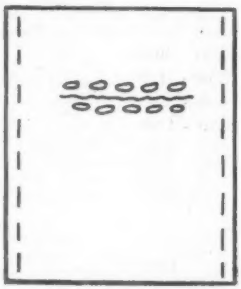

FIG. 4.

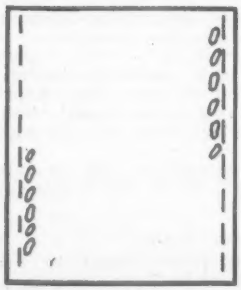

FIG. 5.

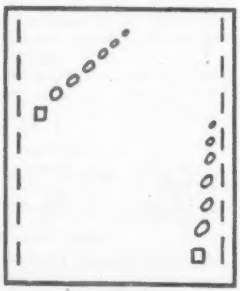

FIG. 6.

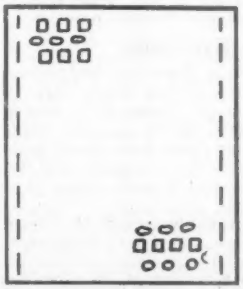

FIG. 7.

FIG. 8.

coloured holes associated with grey to yellow crystalline structure on the fracture and often is the cause of leaky castings.

The defect has a spongy appearance and is due to water vapour formed by pouring metal into a green ladle. A ladle should be lined with a mixture of silica sand and fire clay to dry properly. Clay alone will not give up its water under regular methods of drying.

Where a crucible is used as a ladle, it should be preheated to a bright red, as some of the binding material may not be sintered and may contain moisture. Some of the test-bars under these conditions will barely pass and others will fail.

Effect of Dirty Ladles

Fig. 8 shows a defect caused by dirty ladles. The holes are large to small, clean, yellow in colour, and in a straight line. The defect does not affect the pressure-tightness of the casting.

These gas holes look like "flying geese," and are caused by a small piece of oxidised metal entrapped in slag that has entered with the stream while pouring. This will happen when the metal covers an old slag line lower in the ladle lining. The oxidised metal is reduced and the gas is released within the casting. Neutral slag does not throw off gas. A piece of oxidised metal can be minute in size and still produce a good sized string of holes.

Use clean ladles and put phosphorus in bottom of the ladle, allowing enough time to elapse for the reaction of the phosphorus to take place and for the metal to calm down.

Cope Removed Too Soon

Fig. 9 shows a fine crack with a dark crystal fracture which generally causes the casting to leak. This defect is caused by removing the cope too quickly and allowing the casting to remain in the drag. Uneven contraction, caused by shaking out while too hot, will crack these alloys. Let the castings cool within the moulds. If the exposed surface of the casting turns black after removing it from the mould, the casting has been taken from the mould while it is too hot. Test-bars are likely to heat crack and fail if removed from the mould while they are too hot.

Too Rapid Cooling

Fig. 10 illustrates a defect caused by cooling the casting too rapidly. This defect consists of fine, dark, checkered lines which show up after machining. If pressure tested, the casting will leak. This defect may be caused by placing the casting in a sandblast while it is hot, or by trying to cool the outside surface

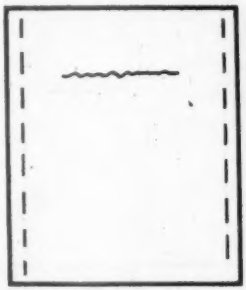

FIG. 9.

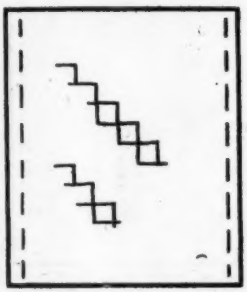

FIG. 10.

FIG. 11.

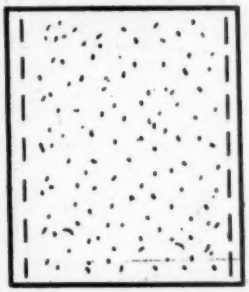

FIG. 12.

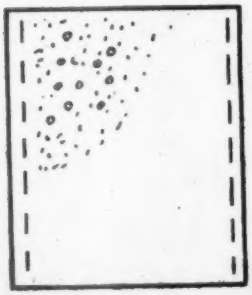

FIG. 13.

FIG. 14.

FIG. 15.

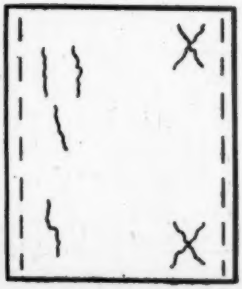

FIG. 16.

Causes of Porosity in Gunmetal Castings

by air or water spray. Allow the casting to cool within the mould naturally. Here, again, test-bars are likely to heat-check and fail if removed from the mould while too hot or if cooled too rapidly.

Pouring Metal Too Hot

Fig. 11 shows a defect caused by pouring the metal while it was too hot. It appears as an orange, yellow or golden cleavage in the wall of the casting and causes leakage.

The too-high pouring temperature has destroyed the advantage of directional solidification. Such a defect indicates that the metal was poured at least 90 deg. C. above the proper temperature.

Test-bars cast under these conditions will be lost, some dropping to as low as 6.6 tons per sq. in. tensile strength and 5 per cent. elongation.

Overheating and Soaking

Fig. 12 illustrates a defect due to overheating and soaking the metal. It is characterised by a porous, evenly-distributed sponginess. The sprue may have shrunk, but a small copper-tin button usually is forced out on top of the shrink. Such a defect may cause the casting to leak. Do not heat the metal more than 55 deg. C. above the temperature needed to cast it, and do not let it soak in the furnace.

Test-bars cast under this condition will be lowered in physical properties, with many not passing the requirements.

Poor Furnace Combustion

Fig. 13 illustrates porosity consisting of clean brown, red, orange and golden yellow holes. This type porosity causes leaky castings, and is due to improper combustion in the melting furnace.

Metal absorbs gases rapidly under high temperatures and reduces atmospheres, and this gas is liberated in proportion to its cooling rate within the casting. In oil, gas-fired and coke furnaces, a slight amount of unburned oxygen in the combustion discharge is desirable.

The sprue and risers do not shrink when metal is gassed. They usually bulge on top. Test-bars cast under this condition will fail, some dropping to as low as 11 tons per sq. in. tensile strength and 10 per cent. elongation.

Steam Holes

Fig. 14 illustrates a defect known to be caused by steam and occurring just opposite a soft spot in a

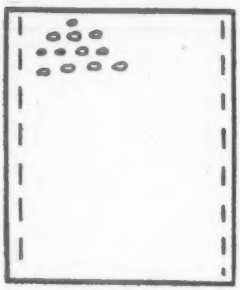

FIG. 17.

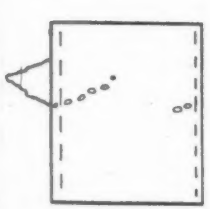

FIG. 18.

FIG. 19.

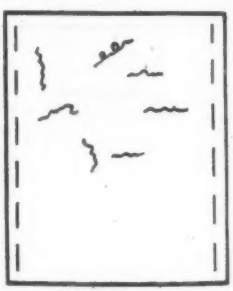

FIG. 20.

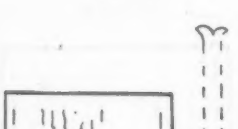

FIG. 21.

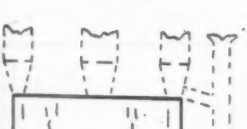

FIG. 22.

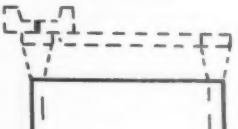

FIG. 23.

FIGS. 24 (LEFT) AND 25 (RIGHT).

mould. The steam holes are golden yellow in colour, but do not affect the pressure-tightness of the casting. The metal becomes embedded in the sand of this soft spot and shuts off its vent to the outer mould, driving water vapour back into the casting.

Gas Holes

Fig. 15 shows a defect which does not affect the pressure-tightness of the casting. It consists of gas holes of golden yellow colour and occurs opposite a soft spot in a core. The metal embeds some of the sand completely and shuts off the vent into the core, driving back gases into the casting.

Low Hot Strength

Fig. 16 shows a defect characterised by porous grain structure under spots where the metal has drained into the core, causing fins, etc., often resulting in leaky castings. In this case, it will be found that the core lacked sufficiently high hot strength, and that segregated alloy, of different analysis than the casting, has drained from the casting, leaving a structure that often will leak.

In analysing fins that eat into the cores on a casting made from an alloy containing 88 per cent. copper, 8 per cent. tin and 4 per cent. zinc, one is likely to find 72 per cent. copper, 16 per cent. tin, and 8 per cent zinc. The metal that penetrated into the core has a lower melting temperature than that of the casting, and drains out through the grain boundaries, leaving a structure that is porous. Risers will not always take care of this condition. Metal will not penetrate into cores any more than moulds, when they have the same hot strength.

There are four methods used to overcome this infiltration. They are: (1) the use of more moulding sand in the core mixture, (2) addition of clay, (3) addition of silica flour, or (4) the addition of ferric oxide. Ferric oxide does not lower the permeability of the core appreciably, and is recommended where clay or fines are not permissible.

Improperly Dried Charcoal

Fig. 17 shows a defect consisting of large and small, clean holes which range from orange to yellow in colour. This defect, while seldom affecting pressure-tightness, may also show a granulated structure.

The condition is due to placing improperly dried charcoal in the bottom of a ladle and pouring metal on top of it. Charcoal contains water and, unless dried just before using, the moisture will combine with the metal. Test-bars under this condition are likely to fail.

Fins and Cracks

Fig. 18 illustrates a defect caused by a fin in the casting or a crack in the mould. It is characterised by even sized, clean holes of golden yellow colour. The defect does not affect the pressure-tightness of the casting.

In this case, directional holes are driven back into a casting by a fin or crack in a mould. In both green and dry sand moulds, the fin shuts off the vent in the sand, and the gas generated in the corner pockets is forced into the casting.

Paste in Core Seams

Fig. 19 shows a defect consisting of small to large, clean, golden yellow holes. These are steam holes caused by paste or mud in the core seams. This defest does not affect pressure-tightness.

Core seams should be filled with a fine moulding sand and blackened over. If a piece has broken out of the core, paste in a section of core to fill the hole. Do not fill in with mud or black lead. Pasted overbaked and underbaked core halves will often rip on the seam and produce similar holes.

Dross Inclusions

Fig. 20 illustrates dross inclusions embedded in the side walls of a casting. They are oxide films, and appear red and green coloured on fracture. This defect seldom affects pressure-tightness, except when the film extends completely through the section.

These oxide films generally result from excessive strings of oxidised metal on the lip of the ladle. Metal should contain enough phosphorus to dissolve these films, otherwise they will flow back into the casting and will not redissolve. Usually 0.01 per cent. phosphorus will counteract this trouble. This is usually added as 1½ oz. of 15 per cent. phosphor-copper shot.

Some test-bars will be lost from these films. As a rule, the others will show exceedingly good properties, due to the metal being on the oxidised side.

Improper Gating

Fig. 21 shows a defect due to improper gating. This defect appears as a coarse, crystalline structure of brown, red, orange and golden yellow on fracture. It is internal shrinkage and will cause castings to leak.

Incorrect Risers

Fig. 22 shows the result of using a properly proportioned gate, but an improperly proportioned riser. The defect shown above appears as a coarse, crystalline structure which is brown, red, orange and golden yellow on fracture. This defect is internal shrinkage due to risers being too far apart. Castings with this defect will leak.

Ideal Gating and Risering

Fig. 23 illustrates the ideal method of gating and risering, the type casting being discussed to produce sound castings. The author believes that the best method is to employ a ring riser with pencil gates so proportioned as to produce directional solidification. For this casting, four ¼-in. pencil gates should be used, together with a pouring temperature of approximately 1,135 deg. C.

Test-bars for Gunmetal

In checking test-bars that have failed, personal experience has been that losses can be classified approxi-

(*Continued overleaf, col.* 2.)

MALLEABLISING WITH MIXED CO/CO_2

ALLOY AND ALLOY-FREE IRONS

A study of the reactions occurring during the decarburisation of alloy and alloy-free irons with mixed carbon-monoxide/carbon-dioxide atmospheres is described in "Archiv fur das Eisenhüttenwesen" (March, 1943), by W. BAUKLOH, F. SCHULTE, and H. FRIEDERICHS.

Decarburising investigations were undertaken on white, chilled cast iron in a mixed carbon-monoxide/carbon-dioxide atmosphere at temperatures between 950 and 1,050 deg. C., and the influence of controlling factors such as sectional thickness, time of heating, temperature and gas composition, also the influence of the carbon content in the original cast iron, as well as that of manganese, nickel, chromium vanadium, molybdenum and sulphur on the speed of decarburisation were investigated. In addition, the diffusion constants of carbon in iron were determined, and the mechanism of the reaction occurring during the decarburising process was comprehensively clarified.

The results obtained may be summarised as follows:—

(1). The speed of decarburisation increases with rising temperature; the actual decarburisation occurring is much greater during the initial first two hours of the heating than after a further 2 hrs.' heating, and plotted against time, the decarburisation curve is a hyperbolic function falling from the relatively high initial decarburisation speed.

(2). Volatilisation of the carbon occurs within practical limits only on the surface of the specimen being treated. The carbon required to maintain the decarburisation migrates from the interior to the outer surface. The velocity of the decarburisation is determined by the speed of this carbon migration. The work demonstrated the tenability of Ledebursch's theory of the decarburisation reaction.

(3). The rule, established in the case of steels, that the amount of carbon volatilised within a given period of time is proportional to the initial carbon content of the material, may be applied without qualification to hypo-eutectoid white cast iron. Inclusions of primary cementite appear after a short period of heating, which increase in amount with increasing carbon content of the material, and this depresses the speed of diffusion of the carbon and in consequence the velocity of decarburisation. After further heating, this preliminary retardation, however, becomes scarcely noticeable.

(4). Manganese, nickel, chromium and vanadium have little influence in small additions, and with larger amounts of these elements, an unfavourable influence is exerted on the decarburisation velocity. Only molybdenum was found to raise the speed of decarburisation, at 1,050 deg. C.; at 950 deg. C., the effect of this element is similar to the others in being unfavourable. Sulphur also appears unfavourably to affect the decarburisation.

(5). With a low velocity of the decarburising gas atmosphere, optimum speed of decarburisation occurred with a gas mixture of about 28 per cent. CO_2 and 72 per cent. CO.

(6). Carbon-dioxide contents of above about 28 per cent. gave rise to scaling of the iron and also to a reduction of the decarburising speed.

(7). White cast iron can be decarburised without scaling taking place with a broad range of gas composition, corresponding to the composition of the former, provided that a certain carbon limit is not exceeded; if this carbon limit is reached in the cast iron, the carbon-dioxide content of the furnace atmosphere must be reduced, to avoid scaling.

The results obtained with straight carbon-dioxide/carbon-monoxide mixtures may be improved with gaseous mixtures of carbon dioxide and carbon monoxide, containing nitrogen as an addition, provided that a suitable ratio of CO_2:CO is employed, together with a sufficiently high speed of the gas. However, care must be taken here that the surface decarburisation proceeds at a speed corresponding to the diffusion velocity of the carbon.

POROSITY IN GUNMETAL CASTINGS

(*Continued from previous page.*)

mately as follows, according to the type of failure:—

Defect.	Per cent.
Water vapour	... 75
Gassed metal	... 10
Hot pouring	... 5
Cold pouring	... 3
Oxidised films within the bars ...	... 2
Other causes	... 5

In the author's experience, foundries which have had the most outstanding results on test-bars are those which use skin-dried moulds or cores, using the fin gate type bars (Fig. 25) recommended for "G" metal by the Navy and A.S.T.M. One company casting in a core averages 21.4 tons per sq. in. tensile strength with 36 per cent. elongation. Another company, using a core and this same dimension bar but widening the riser at the top to 4 in., as shown in Fig. 24, and tapering it down to $\frac{5}{16}$ in. at the point where it joins the casting, is able to maintain high tensile strengths and increase the elongation, on an average, to more than 55 per cent. The cores must be kept warm and dry to maintain these high properties.

MODERN FOUNDRY PRACTICE*

By C. R. DAY

The Author Reviews International Foundry Industry Developments

The object of this Paper is to detail the way in which the foundry industry is progressing, and how the larger foundries of the world, such as those engaged in the automobile trade, manage to attain their tremendous output of castings. The information for this lecture was gained largely through a trip overseas made in 1937. During this time the author visited many foundries in England, France, Germany, and the U.S.A.

Probably the greatest progress in the industry has been made in America, because the foundries of that country have in the majority of cases much larger outputs than those of other countries. As an example of this, the Chevrolet plant of General Motors in Saginaw, U.S.A., which at that time was melting 2,000 tons of metal over a 16-hr. working day. Such large outputs allow for full mechanisation of the foundry.

In England developments have not proceeded to the same extent as in America, although many of the larger plants have turned to mechanisation wholly or in part. The neatest and most efficient plant inspected was located in England. This was the Midland Electric Manufacturing Company, of Birmingham.

Mechanisation has been widely applied for some years in every industry where handling of materials has to be undertaken, and its success has been so pronounced that it is now accepted as being indispensable. The term mechanisation with reference to foundries indicates the use of mechanism to ensure an automatic continuous moulding and pouring system in which the moulding sand is conveyed to the moulding machines, the completed moulds mechanically conveyed to the pouring station, the poured moulds passed to the knock-out position, and the knock-out sand automatically treated, conditioned, and deposited on to a conveyor which takes the finished sand back to the moulding machine hoppers.

Where the output of castings is very large, the installation of a mechanised plant complete in every detail is usually warranted, and even in the smaller foundry where outputs can be met by the installation of a few moulding machines, or even hand moulding, or both, a more limited application of mechanisation can become a sound economic proposition.

It will be found that if a careful time study is made of the usual moulding operations in an ordinary foundry, the moulder very often does not spend more than one-quarter to one-fifth of his time in the actual production of moulds, the remainder being spent in general labouring, conveying the moulds to the floor, coring up, pouring, knocking out, etc., all of which can be done more expeditiously and economically by lower-rated labour with the judicious addition of mechanical appliances.

Moulding Machines

A moulding machine has been defined as "a mechanical aid to rapid mould production." Every foundryman has some idea of a moulding machine, but it is doubtful if more than 50 per cent. of those engaged in foundry work are entirely familiar with the various types available. There are approximately six types of moulding machines used in modern foundry work, *viz.*:—(1) Power squeeze; (2) boxless; (3) squeeze pattern draw; (4) jolt squeeze pattern draw; (5) jolt-ram turnover pattern draw, and (6) sand-slinger.

The power squeeze machine is the modern edition of the hand squeeze. These machines use snap or tapered flasks for producing a boxless mould, the average output per man in a mechanised foundry being 20 to 25 moulds per hr. As one man handles the mould, only the smaller types of castings are made, the maximum size of mould produced having a surface area of approximately 250 sq. in., with the top and bottom half each about 4 in. deep. The disadvantage of this machine as compared with other types is that the operator has to draw the pattern plate by hand, therefore more skill is required and a longer training period is necessary for the operator to become proficient. Broken moulds are more frequent, and time is required for patching. These machines are usually equipped with a jolter for slightly ramming the bottom half of the mould, especially if the pattern is of some depth.

The magnetic boxless machine, as its name implies, produces a boxless mould similar to that from a snap flask. No tucking or jolting of the sand can be done, the required hardness of the rammed sand being obtained solely by the squeezing operation. For this reason the machine can only be used for shallow patterns. The advantage of this machine over the power squeeze is that the machine draws the pattern, resulting in a cleaner mould and also its greater speed of output, up to 60 moulds per man per hr. being produced comfortably. It is not advisable to use this machine for making moulds which require cores, as the time taken in setting the cores keeps the machine idle, with consequent loss of production. The size of mould produced by this machine is 17 in. by 12 in., with cope and drag each 3 in. deep.

The squeeze pattern draw machine rams the sand into the mould by a pressing or squeezing operation. The press head is either brought down to the filled moulding box and pressure exerted on the top, or the box and sand is lifted up to the press head. The machine is confined to shallow work, two machines

* A Paper read before the Institute of Australian Foundrymen. The author is Metallurgist, H. V. McKay-Massey Harris Pty. Ltd.

Modern Foundry Practice

form a unit, one making the drag and the other the cope part of the mould. Cores are set by a third operator.

In the production of stove and grate castings where the boxes used are of comparatively large area, but very shallow, and where it is difficult to ram the sand satisfactorily under the cross bars of the boxes, a type of squeezing known as the "down sand frame" method is used. In this method instead of the sand being pushed down on the pattern, the pattern is pushed up into the moulding box, so that the sand is rammed hardest near to the mould face, entirely the opposite effect to that obtained when the pressure is applied to the backing sand.

The jolt squeeze pattern draw machine is in general use for the average run of castings, and is excellent for making moulds from comparatively deep patterns, which cannot be rammed satisfactorily by pressure from the top. As its name implies, the sand is rammed by jolting, followed by a squeezing action. By first giving a few jolts to pack the sand close to the pattern and particularly down the sides, afterwards finishing off the ramming by squeezing from the top, a well-rammed mould is obtained, the time taken for the complete operation being only a few seconds longer than is required to squeeze a mould which is plain and shallow.

Similar to the squeeze pattern draw type, two machines form one unit, cores being set by a third operator. The number of moulds which can be produced by these machines, *i.e.*, the squeeze pattern draw and jolt squeeze draw, is about 120 to 180 per hr., making an average of 60 to 90 complete moulds per man per hr. This does not include the core setter, who would, of course, bring the average per man down to 40 to 60 moulds per hr.

The jolt-ram turnover pattern draw machines ram the mould by a jolting action, turn it over, and draw the pattern upwards out of the mould. For medium and fairly large work they have several advantages over the types previously described. The half moulds can be turned over much more readily by the machine than by one of the foundry cranes.

Stripping plates are often used with patterns mounted on plates where the shape renders it difficult for a perfect draw to be obtained by the ordinary method. They consist of flat parallel plates closely surrounding the patterns, and registered in position by the same means as the pattern plate. When the patterns are drawn, these pass through the stripping plate, which being hard up against the joint, protects the mould from damage round the edges, where the draw is straight and comparatively deep. The patterns must be made deeper by the thickness of the stripping plate.

The sand-slinger may be used for the ramming of both large and small moulds. This machine throws the sand into the mould at a very rapid rate and with a force sufficient to give a tight packing. A sand-slinger is often used in conjunction with a plain strip or pattern draw machine. When used in this way a number of machines are often placed on a continually revolving grid, which passes them beneath a stationary sand-slinger. The box is filled with sand and passing on to other operators has the pattern drawn, etc., and is placed on a continuous conveyor running alongside the revolving grid. The moulding machine with another box in position again passes under the slinger, and so on. Two of these set-ups are necessary to form the complete mould, one unit making the drags and the other the copes. Any cores required are set during the short journey of the drag to the cope units.

Pattern Plates

It was mentioned that moulding machines were defined as mechanical aids to production, but it must be borne in mind that the success of any machine depends largely on other aids outside its own scope—such, for instance, as good patterns, boxes, sand, and the interest and intelligent working of those in charge. In order to achieve high production from a modern moulding machine, the pattern plates must be well made. Production cannot be held up while an operator patches a faulty mould.

Great care is taken in pattern plate manufacture, and the surfaces are very highly finished, as file marks and seemingly unimportant blemishes all help to catch sand and make the drawing of the pattern difficult. Many problems of the foundry can be overcome by careful pattern design, and adequate draft angles and liberal fillets make all the difference between easy and difficult drawing. One degree draft should be considered an absolute minimum, and at least 5 deg. where possible.

Sand Treatment

In the high-production foundry sand is supplied to moulding machines from hoppers which are fed from overhead conveyors. There are two distinct types of conveyors used for sand distribution. They are:—(1) Push-plate type, and (2) belt type. The push-plate type consists of a steel trough with the moulders' hoppers attached underneath. A series of steel plates mounted upon a chain moves along the trough pushing the sand ahead. The holes from the troughs to the hoppers are staggered, making this type fully automatic and requiring no attention beyond lubrication from time to time. The belt conveyor is a flat belt from which the sand is removed by adjustable ploughs. This type requires a man in attendance to control the filling of the hoppers.

After the mould has been poured, to remove the casting, the mould is placed on a knock-out which is a high frequency vibrating screen. The hot sand falls through this screen on to a conveyor, from which it is elevated to a breaker screen. This breaker screen is a rotary screen covered with approximately ¼-in. mesh wire. Inside the screen are blades which pick up any lumps of sand and let them fall, eventually breaking them fine enough to fall through. The screen rejects cores, core wires, and lumps of scrap metal which have passed through the knock-out.

The breaker screen is connected with an exhaust system to remove some of the fines from the hot, dry sand. This is an essential part of the equipment as the permeability of the sand must be maintained. The sand falling through the breaker screen is removed by a belt conveyor and passes over a magnetic pulley which removes any remaining metal. The sand is then discharged into a storage hopper. From this hopper it feeds to the mill, from the mill through an aerator, and discharges once again on to the overhead conveyor which distributes it to the moulders' hoppers. The sand passes through this circuit about two or three times per day. The number of passes is limited, as sufficient time should be allowed for the sand to cool down.

The methods adopted to introduce new sand and coal dust into the system vary slightly. One method is to instal two hoppers over the conveyor belt, taking the sand from the knock-out to the breaker screen, these hoppers being provided with rotating circular plate bases which continuously feed fresh supplies into the system. Another method is to place on each cast-up mould a predetermined amount of new sand and coal dust.

In the modern foundry the sand treatment plant has become the most important operating unit. Progressive foundrymen are now beginning to devote as much time to control of sand as they do to control of metal, realising that more labour hours are involved in sand than in any other material used in the foundry. Close control of the moulding sand in the mechanised foundry is essential, and tests are conducted at frequent intervals to ensure its properties are constant.

The majority of mechanised foundries have a universal sand, *i.e.*, the one sand serves both as a facing and backing sand. Moisture and coal dust content, strength and permeability should all be kept within fine limits. The term permeability refers to the venting qualities of the sand, *i.e.*, a sand of high permeability allows easy escape of gases because of its openness. The permeability of a sand is ascertained by measuring the rate of flow of air through a standard specimen of sand under a given pressure. It should not be confused with the term porosity. A fine-grained sand of equal-sized grain would have the same porosity as a similar sand of coarse grain size, but the permeability of the finer-grained sand would be less because of the resistance to gases offered by the larger surface area of such a sand.

Mills for sand milling may be divided into two types. (1) Continuous type, and (2) batch type. The former is represented by (*a*) Morris; (*b*) Ronceray; and (*c*) Baker & Perkins, and the latter, *i.e.*, the batch type, by (*a*) Simpson, and (*b*) Beardsley & Piper's speedmullor.

The Morris mill consists of a horizontal drum contained enclosing two horizontal rolls turning together but at different speeds of rotation. Blades fixed to the inside of the drum lift the sand and drop it between the rollers. The sand is fed in at one end and discharged at the other. The slope of the drum may be varied to control the degree of blending and the volume of output. The Ronceray mill consists of a horizontal cooling plate on which are two rollers. The sand is fed on to the centre of the plate and gradually moves to the edge where it is removed by a plough. The Baker & Perkins type, which is used in many plants in the U.S.A., consists of two revolving shafts fitted with paddle blades.

The Simpson is a pug mill, the pan being stationary and the two rollers rotating round a central shaft. It can be adapted to a continuous sand handling plant by a unit of two mills feeding an equalising hopper from which a continuous supply of sand can be taken.

The Beardsley & Piper speedmullor consists of a wear-resisting bowl about 5 feet diameter, and mulling mechanism which is a cross-head mounted on a vertical shaft revolving at 90 r.p.m., from which two 20-in. diameter rubber-covered spherical mullors are pivotly supported to swing outward by centrifugal force, being adjustable as to throw.

Mould Storage and Pouring

As to the storing of moulds before being poured, the foundries may be divided into two types: (1) Those where the supply of molten metal is intermittent, such as in steel and many malleable foundries. (2) Those where the supply of molten metal is continuous. In the former type, which is usually referred to as the batch method, the moulds are stored on gravity roller tracks, and after pouring are knocked out on a grid at the ends of the tracks and at right angles to them, or may be transferred to another roller track and so conveyed to the knock-out. Gravity rollers find their greatest use in jobbing shops and in those foundries where the output is not sufficient to keep a cupola going over the full working day. They provide a very flexible foundry, as moulds can be held until suitable metal is available.

In the continuous method the moulds are taken from the machine to the pouring station and knock-out by a continuously moving conveyor. This type of conveyor may be further divided into two types. One is the pendulum, which consists of rods or pendulums suspended from carriages which run on the bottom flanges of overhead girders. Attached to the bottom of the rods are the plate which carry the moulds. The overhead travelling carriage has a chain attached, the links of which engage with the teeth of a driving sprocket, and a continuous motion is thus obtained. Having its driving mechanism overhead, the wearing parts of the pendulum type of conveyor can be kept free from sand, and this is an advantage over other types.

The other form of continuous conveyor is the platform in which the motion is obtained by the links of an endless chain attached to the underside of the mould conveyor engaging with the teeth of a sprocket driving wheel or similar driving mechanism. Early types of this conveyor had the mould carrier sliding along fixed rails, but the latest types arrange for the carrier to run on rollers, this reducing the amount of friction. Other platform types are those where each mould carrier is really a small flat-top truck, the trucks running on rails, and the driving motion being obtained by means of projections on an electrically-driven belt or chain engaging similar projections attached to the underside of the mould carriers.

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Both the pendulum and platform types have their advantages and disadvantages. In a foundry, to keep wearing parts free from sand is quite a problem, and in this regard the pendulum type is less likely to cause trouble as the driving mechanism is overhead. However, the wearing parts on the platform type are well protected, and of the two this is probably the more popular form of conveyor.

In the mechanised foundry the ventilation problem is an important one, as pouring takes place over the full working day. Where moulds are stored on gravity roller tracks, as in the batch method, and pouring is intermittent, it is difficult to keep the atmosphere in the foundry clean, but where a continuous type of conveyor is used, immediately after pouring, the moulds enter a cooling tunnel built over the conveyor and extending to the knock-out position. The fumes, etc., are exhausted from this tunnel. At the knock-out an exhaust fan is also usually installed to keep steam and other gases away from the operators.

Melting Equipment

For melting the metal in the modern foundry, the cupola is still the most popular medium, and is likely to remain so in spite of the fact that it has been described as a "metallurgical abomination." The balanced blast cupola is used in many foundries in England, but in America the Whiting is predominant. The latter type of cupola usually has a double row of tuyeres, whereas the balanced-blast type has four rows, including the main tuyeres, although the tendency is now to do away with the top row.

The U.S.A. foundries tap their metal very hot from the cupola, the temperature being round 1,500 deg. C. It is their practice to use a rather high bed, approximately 4 ft. above the tuyeres, and a ratio of metal to coke in the charges of about 7 or 8 to 1. Also the pressures developed in the wind belt of the cupola appear to be lower than the British practice, caused by a lower ratio between the cross-sectional area of the cupola and total area of the tuyere openings.

To produce good metal from a cupola running continuously for sixteen hours, as was the case at the Chevrolet plant mentioned earlier, requires very good practice. It makes one shudder to think of the metal which some foundries would produce if they had to run for even eight hours. Where cupolas are run for such long periods two are installed, being run on alternate days. Preheating of the air blast is practised by some plants, *e.g.*, the Griffin Wheel Company, of Chicago, U.S.A., have a hot blast and claim quite good results from it, metal to coke ratios being as high as 16:1. The air was preheated to a temperature of approximately 370 deg. C.

Charging of large diameter cupolas is usually done mechanically. This may consist of bucket elevators, tip-up skips, or drop-bottom cans. Care should be taken to see that the charge is distributed evenly, and where bucket elevators or tip-up skips are used, it is often necessary to have a man raking the charge to keep it even. For this reason the drop-bottom cans have an advantage over other types. Where mechanical charging is in use on cupolas the life of the lining is often considerably decreased. To overcome this, cast-iron plates are usually set in the lining near the charging door, and the metal charge strikes these, thus preventing damage to the furnace walls.

These foundries are melting continuously throughout the day, as would be necessary with a continuous casting plant, and where only one cupola is in use owing to a small output, it is the usual practice where more than one composition of metal is desired to run a base iron through the cupola and obtain the other composition by additions of the necessary ferro-alloys at the cupola spout. This may be done by installing a funnel containing the alloy over the spout, and the time of emptying the funnel is synchronised with the time required to fill the ladle. This ensures a good mix of the alloy throughout the metal.

The majority of foundries control the composition of their metal at the cupola spout by means of chill cast test-pieces. The depth of chill obtained gives an indication of the silicon content, and also an idea of the denseness and hardness of the metal which might be expected in the resultant casting. If the metal is too hard and requires softening, an addition of powdered ferro-silicon, calcium-silicide, nickel shot, or a fine form of graphite is made, but if the metal requires hardening, an addition of ferro-chromium is made.

Such tests allow the machining qualities of the metal to be kept constant, a very important factor in high production plants.

In addition to chill control tests, transverse test-bars are cast at frequent intervals, in some cases one every hour, and more frequently should the occasion demand it. These test-bars are 1.2 in. dia. The American bar is broken on 12-in. centres and the British on 18-in. centres. Many foundries run the molten metal from the cupola continuously. By that it is meant that the tap hole is never botted. Some make use of cylindrical receivers, these being constructed in such a way that they can be filling a ladle whilst still receiving molten metal from the cupola. The capacity of the receiver is usually about one-quarter of the hourly output of the cupola. Another method is to have at the end of the main spout another spout forming a "T" with the former. The latter spout is pivoted and is capable of being tilted in opposite directions. As soon as one ladle is filled the spout is tilted to fill the other ladle.

A syphon brick is used by some for controlling the supply of molten metal, the brick being placed inside the cupola at the tap hole. The brick has three holes, and metal is tapped from the bottom one for a start, but as the metal rises in the cupola well and syphon, this hole is botted up and the second one used, and so on to the top hole, through which the metal is tapped for the remainder of the day. The flow of metal from the cupola is regulated by air blast. When the blast is on, the pressure inside the cupola forces the metal out of the top hole, but when the blast is

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Modern Foundry Practice

shut off the flow of metal ceases. A disadvantage of this method would be the intermittent blast which would tend to give dull iron, but users of the brick claim that this does not cause any trouble.

The metal is distributed through the foundry by ladles hung from monorails. In small foundries these are attended by one man, but in the larger foundries a motor also suspended from the rail and attended by one man pushes or pulls the ladle round. Monorails are also used to assist men during the pouring of the moulds, and in this way one man can handle quite a large amount of metal. The hand ladles are usually equipped with some form of skimming device, in many cases this being of the semi-teapot type.

For transporting steel and low-silicon iron around the foundry, closed ladles are used owing to the higher freezing points of these metals. After castings have been knocked from the mould they are fairly warm, especially in the case of large castings, and it is the usual practice to hang them from a pendulum type of conveyor and take them for a trip round the outside wall of the foundry before being transferred to the dressing bench.

Fettling

Rumblers are still very popular in many foundries, and it is quite common to go into the cleaning shop of some of the larger plants and be nearly deafened by the noise. In fact, in one plant visited deaf men were employed for this purpose. Widely different sizes and types of castings are cleaned by this method, the more delicate being carefully packed and protected, if necessary, by wooden staves or old motor tyres. Rumbling times vary from 1 to 4 hrs., the average being 1 to 1½ hrs. Shot-blasting is widely used for cleaning purposes. One method used in high production foundries is to pass larger types of castings, such as cylinder blocks, on a continuously moving conveyor through a cabinet in which shot is fired at the casting from all angles. The shot blast cabinet is also used for cleaning larger castings.

The castings and the operator are enclosed in a room or cabinet with a perforated floor, the shot being sprayed over the castings by an air hose. Spent shot falls through the floor, is separated, and the good shot returned for further use. A mixture of angular and round shot is commonly used, the grit having a cutting and the round shot a burnishing action. The operator wears a protective suit, and is supplied with fresh air from outside. For small castings the Tumblast type is used, which is a rotating drum with shot blasted from one or both ends.

The air blast type is now giving way to the airless, of which the Wheelabrator is an example. This machine consists of a steel slat conveyor moving between two disc ends. Several rotor heads are mounted over the conveyor, and these effectively spray the greater area of this conveyor. This means that the machine can be loaded with a large charge, and the castings are rapidly cleaned because the grit has an unobstructed path to the castings, not having to travel to the centre of the drum to reach the centre castings as with some types. The Hydro-blast is really a development of the shot blast. This method consists of cleaning the castings by a high-pressure water jet, and is designed mainly to clean large castings.

Advantages of Mechanisation

In order that a foundry may satisfactorily instal a mechanised plant, the chief requirement is that the output of moulds must be sufficient to take the metal from a continuously worked cupola of practical size, or other working unit running over the full working day. The advantages of such a plant are many:—(1) The regular and steady flow of both materials and products tend to give a very orderly foundry; (2) as castings are inspected shortly after the moulds are made, any defects are immediately found and eliminated before many castings are spoilt; (3) the continuous use of moulding boxes greatly decreases the number required, this being a great advantage over the foundry where moulds are stored before casting, and (4) the floor space required for a given output of castings is enormously reduced, and this means a great saving in overhead charges.

Core-shop

If the foundry is speeded up, then naturally the core-making department must be also. A popular set-up is to have the core benches arranged at right angles to a slowly moving conveyor belt or gravity roller, by which green cores are carried to a continuous drying stove. Dried cores are removed at the far side of the stove, plates being returned on a pendulum type of conveyor, which passes right round the benches and stove, or on gravity roller tracks.

A pendulum conveyor may also be used for the distribution of core sand, the mixed sand being placed in buckets hung from the chain driving the conveyor. As these buckets pass the core benches, the operator tips the sand out and the empty bucket continues on its way back to the sand-preparing mill. To increase the output of cores, core blowing machines are used. Some foundries strike trouble when operating these machines for the first time, but this is mainly caused by not properly venting the core box to allow for the escape of air. Air is allowed to escape by drilling holes in the core box at points where air is likely to be trapped, and fitting in these holes plugs which have the head drilled and are covered with fine wire gauze.

With simple types of cores, often file scratches across the box jointing faces provide sufficient venting. The sand used should be carefully controlled, especially as regards moisture and dextrin content, in order to get maximum flowability. To support the cores for drying, odd sides are used, as the sand is not strong enough to handle in the green state.

Conclusion

In this Paper a rather rapid survey of modern foundry practice has been made. It again might be

(*Continued on page* 318, *col.* 2.)

You're holding up more than a LORRY!

It may seem a little thing if a lorry has to wait needlessly for an hour or so, until you are ready to load or unload or to check a consignment note. But it would seem a big thing, if you were *waiting* for that lorry to bring you some urgently needed goods. And it seems a bigger thing still, when you remember that the goods are going to the fighting men. Today every lorry in use is on war work. Every extra mile it travels speeds our war effort. Don't keep a vehicle, then, *one minute* longer than you can help.

QUICKER TURNROUND THAN EVER BEFORE

Issued by the Ministry of War Transport

You know your own problems best. Tackle them in your own way. But tackle them now. Plan, encourage ideas, improvise if needs be. Here's a starting-off agenda:

1. CLEAR LABELS AND DOCUMENTS.
2. LABOUR SAVING DEVICES.
3. WORK IN BLACK-OUT AND AT WEEK-ENDS.
4. OPINIONS OF "MEN WHO DO THE WORK".

7

METALLIFEROUS MINING IN CORNWALL

British metalliferous mining is worth preserving and should receive State assistance, it is claimed in a memorandum which the Cornish Tin Mining Advisory Committee has sent to Lord Woolton (Minister of Reconstruction), Mr. Dalton (President of the Board of Trade) and Sir William Jowitt, K.C. (Minister without Portfolio). There are good prospects of making new and important discoveries of tin ore in Cornwall, the Committee asserts; but unless the Government intervenes immediately after the war British non-ferrous mining in England may become extinct. Several mines now idle in Cornwall could, it is claimed, again become productive of metal at reasonable cost if reopened with proper equipment and sufficient capital to undertake new exploratory work.

The Committee urges the Government to take the following steps, among others, in order to preserve the industry:—

(1) Alteration of taxation. The Committee favours the percentage depletion method, sufficient allowance for pre-production expenditure and exemption from taxation during the first three years of development.

(2) Appointment of a Metalliferous Mines Commission so as to ensure the continued existence of the four largest producing mines—Geevor, South Crofty, East Pool and Castle-an-Dinas. It is recommended that assistance should be afforded these mines to enable them to undertake approved programmes for development.

Ore-treatment Processes

The Commission would be supplied with funds in block grants from the Treasury to enable it to carry out long-term policies, and it would have powers to assist financially private mining or metallurgical enterprise in approved cases. The first charge on the capital should be the maintenance as producing concerns of the Geevor (tin), South Crofty (tin and arsenic), East Pool (tin and wolfram) and a wolfram mine. These mines employ about 1,300 persons with a gross working expenditure of about £500,000. The Commission would also investigate ore-treatment processes for Cornish tin ores with a view to encouraging improved extraction.

The Committee says that there are considerable quantities of tin and wolfram ore to be mined in the county. The working of this ore is important not only because of the revenue derived, but because Cornish mines are essential for the training of miners; the future of the School of Mines is involved. The decline in British mining, and Cornish mining in particular, is attributable by the Committee mainly to the system of taxation as applied to wasting assets. Its stifling effect, says the Committee, is such that no capital can be raised in the future for any British metal mining unless some radical change is made. Taxation compels a shareholder to pay £2,000 for every £1,000 spent in shaft sinking to deepen an existing mine to maintain its existence. The mines cannot bear such a burden.

PERSONAL

MR. C. D. GIBB has been appointed a director of A. Reyrolle & Company, Limited.

MAJOR W. R. BROWN, D.S.O., has been appointed a director of the Power-Gas Corporation, Limited.

MR. L. S. KINNEAR, secretary of the British Oxygen Company, Limited, has been appointed to a seat on the board.

MR. J. R. WILDER, general manager of the Yale & Towne Manufacturing Company, of Willenhall, has been elected president of the Wolverhampton Chamber of Commerce for the ensuing year.

MR. W. R. BESWICK (London manager), MR. R. W. RUTHERFORD (technical sales manager), and MR. CHARLES ROBSON (secretary), have been appointed directors of Ashmore, Benson, Pease & Company, Limited.

MR. E. J. FOX, having reached the age of 70, has decided to retire from the chairmanship of Davy & United Engineering Company, Limited, after 13 years in that capacity. He will retain his seat on the board. Mr. D. F. Campbell has been appointed chairman. Mr. A. C. Macdiarmid, having been appointed president of the British Iron and Steel Federation, has resigned from the board of the company. Mr. C. S. Gill and Mr. F. B. Findlay, directors of subsidiary companies, have been appointed to the board of the parent company.

MR. W. R. LONG has retired from his position as London manager of Stewarts and Lloyds, Limited, and is living at Bognor Regis. Mr. Long is the son of the late Major M. J. Long, R.A., and was born in Shoeburyness Garrison in 1882. He served in the last war, and then joined the staff of THE FOUNDRY TRADE JOURNAL, and was for several years on the business side before taking up his appointment with Stewarts and Lloyds, where in addition to the London managership he was the chairman of the publications committee. Mr. Long's son, Michael, is serving in the present war.

MODERN FOUNDRY PRACTICE

(*Continued from page* 316.)

mentioned that the use of economic methods of manufacture is not limited to the large mass production plant, but can be applied to quite modest establishments. There are various ways of doing this, and it is necessary to adapt them carefully to the ends sought so as to avoid spending a large sum of money for a small saving of labour. In the running of a continuous castings plant there are many traps for the unexperienced, and as one eminent metallurgist said to me, "The first fifteen years are the worst." However, the production of good castings represents a combination of practical and theoretical factors, and as the attitude toward scientific development in our foundries becomes more sympathetic, we can expect a corresponding increase in progress in the industry.

EVERYTHING FOR THE

PATTERN SHOP

PATTERN LETTERS

BRASS AND IRON DOWELS

"PLASTIFIL" PATENT FILLET

LEATHER AND WOOD FILLETS

RAPPING PLATES

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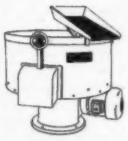
Ask for full details.



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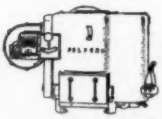
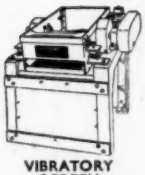
Crucible Furnaces

Other **"POLFORD"** *Products*



PORTABLE MOULD DRYER



VIBRATORY SCREEN

THE HEATON FOUNDRY CO. LTD.

Makers of Foundry Equipment,

HEATON JUNCTION, NEWCASTLE UPON TYNE, 6

COMPANY RESULTS

(Figures for previous year in brackets)

A. Reyrolle & Company—Final dividend of 7½%, making 12½% (same).

Colvilles—Final dividend on the ordinary stock of 5%, making 8% (same) for 1943.

British Oxygen Company—Final dividend on the ordinary shares of 8%, making 15% (same).

Lancashire Steel Corporation—Half-yearly dividend on the 5% cumulative redeemable first preference stock.

Stewarts and Lloyds—Dividend on the deferred stock and on the liaison deferred shares of 12½% (same) for 1943.

Switchgear & Cowans—Profit for 1943, after taxation, £22,653 (£19,150); dividend of 20% (same); to general reserve, £9,000 (£5,000); forward, £12,084 (£10,431).

Manganese Bronze & Brass—Net profit, before reserving £172,500 (£99,500) for taxation, £230,405 (£146,968); final ordinary dividend of 17½%, making 25% (same).

Lanarkshire Steel—Profit for 1943, £54,654 (£50,773); depreciation, £40,000 (same); to reserve, £5,000 (same); preference dividend, £8,250; ordinary dividend of 12½% (same), £11,562; forward, £42,778 (£53,536).

Sir William Arrol—Net profit for 1943, £51,645 (£60,352); ordinary dividend of 15% and a bonus of 10% (same); to contingencies reserve, £20,000 (£25,000 to general reserve); forward, £52,862 (£51,102).

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Star Steel Productions, New Street, Wednesbury—£10,000. V. Stairs and P. S. Thomas.

Harold Beck & Sons, Marley Street, Keighley—Engineers, etc. £1,000. H. and N. M. Beck.

Guildford Engineering Company, Wey Wharf, Walnut Tree Close, Guildford, Surrey—£1,000.

Beryllium & Copper Alloys—£1,000. D. Tellett, 17, Goddington Lane, Orpington, Kent, subscriber.

Yewco (Foundry), Potteries Foundry, Eccleshill, Bradford—Ironfounders, engineers, etc. £1,000. J. R. Phillips.

Scott's Agricultural Works, Orchard Street, Newport, I. of W.—Agricultural and general engineers, etc. £5,000. J. G. and R. P. Scott and A. E. Whatley.

Border Minerals Company, 1, Newgate Street, Newcastle-upon-Tyne—Miners of ironstone, fluorspar, ganister, etc. £5,000. E. Marshall and W. Wardrop.

Nurange Products—Manufacturers of gas and electric cookers, ranges, etc. £500. J. Reynolds, W. A. Millington, L. Newman, and A. E. G. Baring. H. C. Cousins, 139, Welford Road, Shirley, Warwicks, subscriber.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

558,972 SOC. ANON. POUR L'INDUSTRIE DE L'ALUMINIUM. Electric furnaces for the electro-thermal production of metallic magnesium.

558,974 BEDFORD, A. C. Grinding of cutting tools.

558,983 MAGNESIUM METAL CORPORATION LIMITED, and COATES, G. E. Protective surface treatment of magnesium base alloys.

558,986 UDY, M. J. Production of chromium compounds.

558,993 PARKER, O. J. Process of ore concentration.

559,032 LOEWY ENGINEERING COMPANY, LIMITED, and WUTSCHER, T. Stamping machine for rolled material.

559,049 TELEPHONE MANUFACTURING COMPANY, LIMITED, and PADDLE, L. H. Reduction of metals to powdered or granular form.

559,060 REDPATH, BROWN, & COMPANY, LIMITED, and CRAWFORD, W. Construction of girders, beams and stanchions and portable structures made therefrom.

559,071 MAGNESIUM METAL CORPORATION, LIMITED, and COATES, G. E. Protective surface treatment of magnesium base alloys.

559,072 and 559,142 BUDD MANUFACTURING COMPANY, E. G. Method of making stamping dies.

559,082 MESSER, M. Fastening devices for railway rails.

559,117-8 EVERY, C. E. (Titanium Alloy Manufacturing Company.). Purification of crude zirconium compounds or ores.

559,119 MOORE, M. S., and MINING ENGINEERING COMPANY, LIMITED. Combined cutting and loading machines for mining.

559,164 BLOOM, M. C. Electro-deposition of antimony.

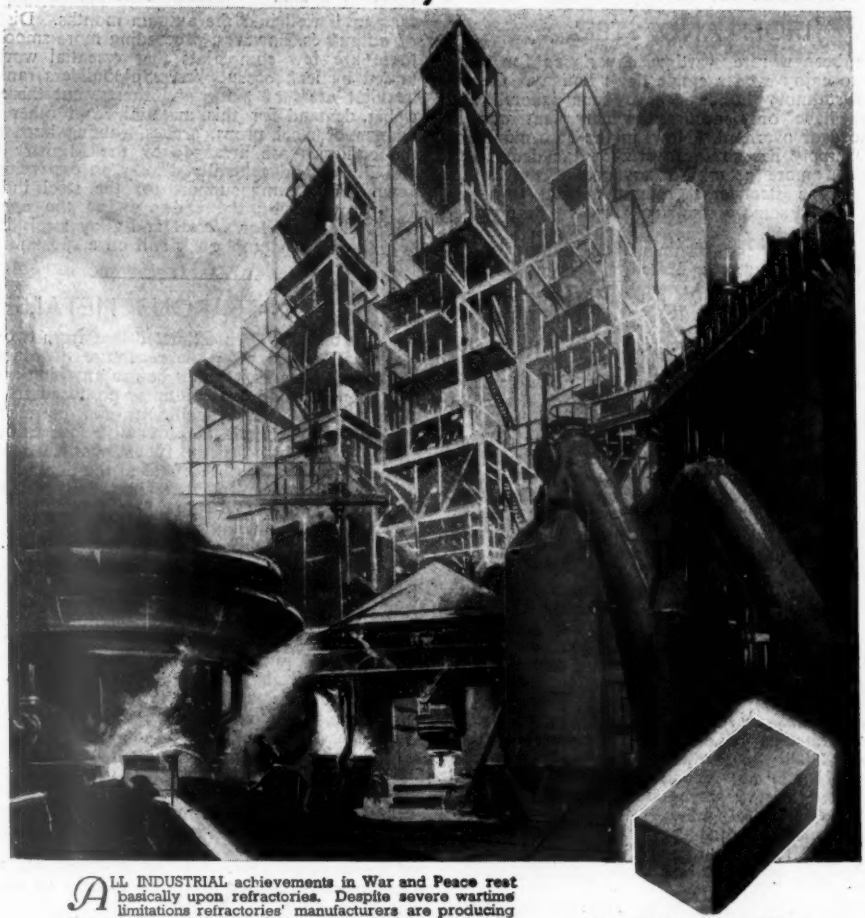
559,295 LIPINSKI, A. V. VON. Production of iron and steel and alloys thereof.

559,310 COLD METAL PROCESS COMPANY. Sheet metal, particularly for use as container stock.

559,349 BOLTON & SONS, LIMITED, T., and HAYES, G. V. D. Dies for the drawing of bar, tube, rod or strip.

MR. F. HOWARD, chief purchasing agent of the United Steel Companies, Limited, addressing the Sheffield branch of the Incorporated Sales Managers' Association, said it seemed to be overlooked that a rapid development of industry had taken place and Sheffield's raw or half-finished materials were providing other parts of the country with easy wealth. He suggested that the manufacturers and leaders of the steel industry in Sheffield should get together on a policy for the production of finished goods. By concentrating more on the production of finished articles Sheffield would be able to offer more employment, and its financial stability would increase.

REFRACTORIES – *Will help to Rebuild Britain*



ALL INDUSTRIAL achievements in War and Peace rest basically upon refractories. Despite severe wartime limitations refractories' manufacturers are producing furnace lining materials which, in quality, keep pace with unprecedented metallurgical development and increasingly severe furnace conditions, thus enabling British Industry to achieve ever greater outputs. In the rebuilding of Britain, G.R. will bring to bear vast manufacturing and technical resources capable of satisfying the needs of users in regard to both quality *and* quantity.

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178

Raw Material Markets

IRON AND STEEL

It has been a rare wartime experience for steelworkers to enjoy even a single day's holiday. Generally, the statutory holidays have been ignored and stoppages have only occurred when plant was in urgent need of overhaul. Now, in the 56th month of the war, supply has so far overtaken the demand as to permit a more general observance of the Easter holiday at the steelworks, although blast furnaces, coke ovens, and some of the steel furnaces were working as usual.

The outlook for the ensuing three months is less unfavourable than was indicated a few weeks ago. Recent bookings for the second period have been on a substantial scale, and promise to keep the bulk of the plants fully employed.

Accumulation of stocks of pig-iron is a commonsense policy in wartime. There are ample supplies to meet an emergency and adjustments have consequently been made to strike a closer balance between production and consumption. This will ease the strain on the railways by lessening the call for the transport of ironstone, limestone and fuel, and as a further means to that end licences are withheld from consumers who have stocks of iron in excess of their immediate needs. Care, of course, is being taken to ensure that no industrial establishment runs short of iron, but foundries have themselves a duty to fulfil in this connection and it is obvious that the importance of the work undertaken must be a consideration in allotting supplies and determining the level of reserves. A steady trade is reported in both high and low phosphorus iron. Refined iron makers are clearing their outputs fairly regularly and, if pressure for hematite is relaxed, it is only because so many former consumers are now using substitutes.

Transport facilities are still the governing factor in regard to deliveries of home-produced steel billets, blooms, slabs and sheet bars. Under existing conditions, irregularities are bound to occur, but users generally have reserve stocks upon which they can draw as the occasion arises. Moreover, defective billets and any shell-discard steel which becomes available are being freely used, and the re-rolling plants are thereby able to maintain a high rate of production.

All the plate and section mills, with the exception of those employed on heavy joists, begin the second quarter with a sufficiency of orders in hand to keep them fully employed throughout the period, and, in fact, until well into the autumn months. Distribution of outputs is, however, proceeding more smoothly and there are few complaints that essential work is retarded by lack of supplies. Shipbuilders rank as the heaviest users of plates and sheets, but there is also a big demand for this material from other sources. Quotas of steel props, arches, roofing bars, etc., for the collieries are arranged by the Ministry of Fuel and Power and generally display an expansionist tendency, and strong support for the steel industry is also provided by the railways and the engineering trade. Pressure for special and alloy steels is not so intense, but consumption is still on a substantial scale.

NON-FERROUS METALS

It has recently been estimated that from two to four years will elapse after the recapture of Malaya and the Netherlands East Indies before anything approaching the normal amount of tin is produced from those areas. Until normal conditions can be restored to the market for tin, all the alternative sources of supply are being developed to the fullest possible extent. Increased attention has been paid to the South American and African mines, and these must be relied upon to be the principal supplying areas for a considerable time to come, including the immediate post-war years. Good prospects of new discoveries of tin ore in Cornwall and the increased working of the mines there have been claimed by the Cornish Tin Mining Advisory Committee. A memorandum has been sent by the Committee to Lord Woolton, Mr. Dalton and Sir William Jowett stressing the desirability of maintaining tin production in this country; it is asserted that unless financial aid is given by the Government immediately after the war, non-ferrous metal mining in England may become extinct. (See "Metalliferous Mining in Cornwall," page 318.)

Attention has been directed to the post-war outlook for copper. The large quantities of war scrap which are certain to be on hand are likely to place the producers of primary metal in a very difficult position. Considerable stocks of both primary and scrap metal will probably have been accumulated, and it is not yet known how these will be disposed of, but the large amounts released are liable to have an extremely disturbing effect on the market.

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